REPORT DOCUMENTATION PAGE

AFRL-SR-BL-TR-00-

0808

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPOF
		1 April 1996 - 31 March 1999

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Mathematical Problems in Imaging, Statisitical Mechanics and Related Topics	F49620-96-1-0127

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
AFOSR 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977	F49620-96-1-0127

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for Public Release.	

13. ABSTRACT *(Maximum 200 words)*

During the duration of this grant I did carry out work on a few loosely related areas, including diffuse tomography, the phase problem in X-ray crystallography, some relations between the Darboux process applied to orthogonal polynomials and the electrostatic interpretation of their zeros, and a number of specific problems related to the bispectral problem. This last one is an area that I initiated about a decade ago starting from a concrete problem in medical imaging. This field has made contact with several unrelated fields in mathematics, ranging from wave propagation, cummulative rings of differential operators, etc. I expect that some of these topics will continue to b eof interest to the Air Force, although some of the efforts may have to be redirected. AS an example I notice that my initial work on Diffuse Tomography could become of some relevance to work being done at the Air Force Research Laboratory at Kirkland AFB, in the Advanced Optics and Imaging Division by Dr. Charles Matson.

20001227 075

14. SUBJECT TERMS			15. NUMBER OF PAGES
			4
			16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

Final report   AFOSR Contract FDF 49620-96-1-0127

"Mathematical Problems in Imaging, Statistical Mechanics and Related
Topics" for the period 4/1/96-6/30/99.

PI   F. Alberto Grunbaum

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could become of some relevance to work being done at the Air Force
Research Laboratory at Kirkland AFB,
in the Advanced Optics and Imaging Division by Dr. Charles Matson.

My work continues to be centered at the crossroads between
"inverse problems" in areas of biomedical interest including X-ray,
Magnetic Resonance and Optical tomography on the one hand and a
number of mathematical developments in areas like mathematical
physics and signal processing. My research program is a two-proned
approach aimed at identifying important areas in "real-life" imaging that
are ripe for improved mathematical treatment. In certain cases this has
given rise to new mathematical developments that should eventually find
useful applications. This work has proved useful in other inverse
problems arising for instance in radar detection, noninvasive evaluation,
and could be useful in the general problem of seeing through turbid media.

I give below a list of the most recent material that has resulted from this contract.

List of submitted publications
****

F.A.Grunbaum, I.Pacharoni and J.A.Tirao
        Matrix valued spherical
        functions associated to the complex projective plane.
        Submitted for publication

F. A. Grunbaum
        Discrete models of the harmonic oscillator and a discrete analog
        of Gauss' hypergeometric equation
        Submitted for publication

F. A. Grunbaum
        Electrostatic interpretation for the zeros of certain polynomials
        and the Darboux Process.
        Submitted for publication

List of recent publications
****

F. A. Grunbaum
    Variations on a theme of Heine and Stieltjes: an electrostatic interpretation
    of the zeros of certain polynomials, J. of Computational and Applied Math. 99
    (1998) 189-194

F.A.Grunbaum and L.Haine
    Associated Polynomials, Spectral matrices
    and the Bispectral problem.
    Methods and applications of Analysis, vol 6 No.6 (2000), pp 209-224

F.A. Grunbaum and L. Haine
    The Wilson bispectral involution: some elementary
    examples, in P. Clarkson and F. Nijhoff (editors) Symmetries and Integrability
    of Difference Equations (Canterbury 1966) London Math. Soc. Lecture Note Series
    255, Cambridge U. Press 1999 353-369

F.A.Grunbaum, L.Haine and E.Horozov
    Some functions that generalize
    the Krall Laguerre polynomials.
    J. Computational and Applied Mathematics 106 (1999) 271-297

F. A. Grunbaum and L. Haine
    On a q-analog of the string equation
    and a generalization of the classical .
    orthogonal polynomials, in L. Vinet and J.F. van Diejen (editors) Algebraic
    Methods and q-Special functions, CRM Proc. Lecture Notes, vol 22, American ·
    Math Soc., Providence, 1999, 171-181

Some papers by other authors that are related to my recent work
****

L.Haine and P.Iliev
    The bispectral property of a q-deformation
    of the Schur polynomials and the q-KdV hierarchy.
    J. Phys A : Math. Gen. 30 (1997) 7217-7227

L. Haine and P. Iliev
    Commutative rings of difference
    operators of an adelic flag
    manifold, to appear in IMRN (International Math Research Notes)
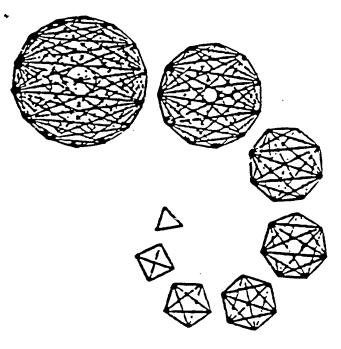
G. Wilson
    Collisions of Calogero-Moser Particles and an Adelic Grassmanian,
    with an appendix by I.G. Macdonald) Inventiones Math. (1998) vol 133 1-41.

G. Wilson
    Bispectral Symmetry, the Weyl algebra, and Differential Operators
    on Curves, Proc. of the Steklov Inst. of Mathematics vol 225, (1999) 141-147.

Y.Berest and G.Wilson
    Classification of Rings of Differential
    Operators on Affine Curves, IMRN (1999) No.2 105-109

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COMMENTS: Here's Alberto Grunbaum's
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TODAY'S DATE: 3/24/00   TIME: 4:20

NUMBER OF PAGES 3   INCLUDING COVER.

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Received: from exchange1.onr.navy.mil ([131.250.16.87])
        by math.berkeley.edu (8.9.3/8.9.3) with ESMTP id HAA24776
        for <grunbaum@math.berkeley.edu>; Mon, 24 Jan 2000 07:59:55 -0800 (PST)
Received: by exchange1.onr.navy.mil with Internet Mail Service (5.5.2650.10)
        id <C9CALS8W>; Mon, 24 Jan 2000 10:59:21 -0500
Message-ID: <F8716F1E0ABAD2118ABF0008C7B162720E117E@seattle.onr.navy.mil>
From: "Jeffres, Alice M." <JEFFREA@ONR.NAVY.MIL>
To: grunbaum@math.berkeley.edu
Subject: F49620-96-1-0127 Final Technical Report
Date: Mon, 24 Jan 2000 10:58:56 -0500
Return-Receipt-To: "Jeffres, Alice M." <JEFFREA@ONR.NAVY.MIL>
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Dr. Grunbaum,

Subject grant has expired. ONR/Seattle has initiated closing procedures.
Please provide your final technical report so my office can complete the
closing process.

Final Technical - The technical report should be submitted to the
appropriate technical or program officer at AFOSR. Submit ONLY transmittal
letter, not the whole final technical report to ONR.

Your cooperation in the timely submission of this report will be
appreciated. If you have any questions please contact me.

Thanks,
Alice

Alice M. Jeffres
Grant Technician
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